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## Pairing Words with Pictures: A Quasi-Experimental Test of Dual Coding Theory for Vocabulary Learning among Young Iraqi EFL Learners

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**ABSTRACT:** Young foreign-language learners in resource-limited classrooms often acquire new words through repetition and translation alone, a practice linked to shallow processing and rapid forgetting. Drawing on Dual Coding Theory (DCT), which holds that memory is strengthened when verbal and visual information are encoded together, this study tested whether a low-cost, paper-based program built around word-image pairings could improve vocabulary outcomes for fifth-grade Iraqi EFL pupils. Using a quasi-experimental, non-equivalent control-group design, 69 female pupils from a government primary school in Al-Najaf (2025–2026 academic year) were divided into an experimental group ( $n = 33$ ), taught 360 curriculum words through twenty-eight dual-coded sessions, and a control group ( $n = 36$ ), taught the same content through standard instruction. Three equivalent twenty-item tests administered before instruction, immediately after, and again seven weeks later for the experimental group only showed acceptable to excellent reliability ( $KR-20 = .72$  to  $.87$ ). The experimental group's vocabulary gains substantially exceeded those of the control group,  $t(67) = 4.58$ ,  $p < .001$ , Cohen's  $d = 2.89$ , and these gains held steady rather than fading over the seven-week interval,  $t(32) = -0.97$ ,  $p = .338$ . Together, the results indicate that combining images with words is a practical and effective way to build durable vocabulary knowledge in a primary EFL setting with few technological resources, and they add Iraqi-context evidence to the DCT literature. The article discusses classroom, curricular, and teacher-training implications, along with directions for future work.

## INTRODUCTION

Every language skill listening, speaking, reading, and writing — rests on a stock of known words, and building that stock is better understood as an ongoing process than as a task that is ever fully finished (AlShammari & Al-Labban, 2024). Wilkins put it plainly: weak grammar still lets a speaker communicate something, but without vocabulary there is nothing to communicate at all (1972, as cited in Agazzi, 2022). For Iraqi primary pupils, though, English rarely extends beyond the classroom door, and lessons still lean heavily on memorization, translation, and drilling, with little room for visual or contextual support (Al-Khateeb & Hasan, 2016; Waham, 2024). This kind of instruction tends to leave words only shallowly learned and quickly forgotten.

One cognitive account of why pairing words with images might help is Dual Coding Theory (DCT), first developed by Paivio (1971, 1986). DCT describes two separate but linked mental systems: one built for language, the other for images and objects. When new material activates both systems at once, the resulting memory trace is theorized to be richer and easier to retrieve than a trace built from language alone. Later work extended this logic to reading, writing, and multimedia instruction more

generally (Clark & Paivio, 1991; Sadoski & Paivio, 2013; Sadoski, 2005), with dual-coded material consistently outperforming single-channel material on measures of memory and comprehension.

Yet despite this theoretical backing, few Iraqi primary EFL programs have actually been built around DCT principles for vocabulary teaching. Local research keeps turning up the same story: Iraqi learners struggling to acquire and hold onto vocabulary (Ahmed & Ja'afar, 2020; Al-Obaydi & Pikhart, 2024) — while classroom practice remains largely rote-based, with theory-driven methods such as DCT rarely reaching the classroom (Mahmood & Arslan, 2017). A handful of recent studies have piloted alternative vocabulary techniques in Iraq (e.g., Lateef & Dakhil, 2025), but a full instructional program built and tested specifically around DCT for young Iraqi learners has yet to appear in the literature. This study was undertaken to fill that space.

## 1.1 Aims and Objectives

This study set out to build a DCT-based vocabulary program for fifth-grade Iraqi EFL pupils and to test whether it actually worked. Three specific objectives guided the work:

- (a) developing an interactive, curriculum-matched program grounded in DCT.
- (b) testing its effect on immediate vocabulary mastery by comparing post-test scores against a control group.
- (c) testing whether any gains held up over time, using a delayed retention test given only to the group that received the program.

## 1.2 Hypotheses

1. The DCT-based program produces no statistically significant effect on the experimental group's vocabulary mastery.
2. There is no statistically significant difference between the experimental and control groups in how much vocabulary each gained.
3. Vocabulary scores in the experimental group do not decline significantly between the post-test and the delayed follow-up test.

## 1.3 Significance of the Study

On the theoretical side, this work supplies context-specific data on DCT from an Iraqi primary classroom, a setting the existing literature has largely overlooked, and checks whether dual-channel instruction delivers the memory and comprehension benefits that cognitive-load and multimedia-learning accounts predict (Wooten & Cuevas, 2024). Practically, the results are meant to help Iraqi teachers and curriculum planners move vocabulary instruction beyond rote memorization by weaving in visual material, and to feed into teacher-training efforts built around affordable, paper-based DCT tools such as flashcards and worksheets an approach that matters most where classrooms have little access to technology (Li et al., 2022; Sadoski, 2005).

## 2. LITERATURE REVIEW

### 2.1 Dual Coding Theory

According to DCT, the mind handles information through two separate channels working in tandem: one tuned to language, the other to imagery, objects, and scenes (Paivio, 1971, 1986, 1991). When a word and its corresponding picture are linked in memory, that link is thought to create two routes back to the same idea rather than one, so recall becomes easier and more resistant to forgetting (Clark & Paivio, 1991; Paivio, 2007). Language teaching has drawn on this idea in various forms, from subtitled film as a vocabulary tool (Kanellopoulou et al., 2019) to animation paired with word definitions (Mohamed, 2021), and the theory sits comfortably alongside broader work on cognitive load and multimedia learning (Mayer, 2020; Sweller et al., 2019).

### 2.2 Vocabulary Mastery and Retention

Vocabulary mastery is usually described as a learner's ability to understand, hold onto, and correctly use words, spanning both the receptive skill of recognizing a word and the productive skill of using it (Nation, 2013; Rahmah et al., 2023). Retention is a narrower, time-bound concept: it asks whether words learned today are still accessible weeks or months later, once they have (or have not) moved from short-term into long-term memory (Nation, 2013; Schmitt, 2010). Both are treated as pillars of EFL proficiency, feeding directly into reading, speaking, and general communicative ability (Schmitt, 2010, 2019).

Research on what makes vocabulary stick points to a consistent set of ingredients: repeated exposure, meaningful practice tied to context, connections across the four language skills, and spaced rather than crammed retrieval practice (Cepeda et al., 2006; Karpicke & Roediger, 2008; Nakata & Elgort, 2021).

## 2.3 Empirical Studies on DCT and Visually Supported Vocabulary Instruction

A number of studies have tested whether combining images with words actually pays off in the classroom. Yanasugondha (2017) found vocabulary gains tied to DCT-based teaching methods, and Wong and Samudra (2019) reported that learners picked up second-language words more readily from media that combined verbal and visual input. Mohamed (2021) showed that pairing animation with word definitions boosted vocabulary learning, and Li et al. (2022), weighing dual coding against a rival cognitive-load explanation, still found evidence favoring dual coding for EFL vocabulary gains. Sadoski (2005) made a similar case for the mnemonic power of concrete imagery in vocabulary learning, a conclusion later echoed in meta-analytic work on graphic organizers and multimedia study aids (Ponce et al., 2025).

A separate cluster of studies has looked directly at mastery and retention outcomes. Noor-ul-Ain and Pervaiz (2023) examined vocabulary strategies among Pakistani ESL learners through a dual-coding lens, and Salehpour et al. (2022) found that literature-based, interactive tasks improved vocabulary retention among trainee teachers. Closer to the present context, Karimi and Shareef (2024) found that instructional games boosted both vocabulary learning and retention among Iraqi primary pupils, and Hameed et al. (2020) reported similar gains from a Scrabble-based game with fifth-grade Iraqi EFL learners. Neither of these last two studies was framed around DCT specifically, but both suggest that structured, engaging interventions work well in Iraqi primary classrooms.

## 2.4 Research Gap

The picture that emerges is one of solid theory and scattered supporting evidence for dual-coded vocabulary instruction, set against a body of Iraqi-context research that keeps documenting the same problem: weak vocabulary outcomes tied to memorization-heavy teaching. What has not yet been done is to build a full, curriculum-aligned vocabulary program explicitly around DCT for young Iraqi learners and test it properly with a control group and a delayed measure of retention, not just an immediate post-test. That is the gap this study addresses.

## 3. METHODOLOGY

### 3.1 Research Design

This study used a quantitative, quasi-experimental design with a non-equivalent control group and a pre-test/post-test structure. Existing school classes were used as the two groups rather than randomly assigned individuals, since random assignment was not practical in a real school setting (Shadish et al., 2002; Rogers & Révész, 2019). A retention measure was added seven weeks after the post-test, given only to the group that had received the program. Table 1 lays out the overall design.

**Table 1** Experimental Design of the Study

| Group | Pre-Test            | Independent Variable | Dependent Variable(s) | Post-Test / Follow-Up      |
|-------|---------------------|----------------------|-----------------------|----------------------------|
| EG    | Vocabulary Pre-Test | DCT-Based Program    | Mastery & Retention   | Post-Test & Follow-Up Test |
| CG    | Vocabulary Pre-Test | Conventional Method  | Mastery               | Post-Test Only             |

*Note.* EG = Experimental Group; CG = Control Group. The follow-up test was administered exclusively to the EG.

### 3.2 Participants

Participants were drawn from female fifth-grade EFL classes at two government primary schools in Al-Najaf Al-Ashraf Governorate during the 2025–2026 school year, selected through purposive and convenience sampling, a common approach in classroom-based quasi-experimental work (Etikan et al., 2016). Two rounds of piloting ( $n = 15$ , then  $n = 69$ ) were carried out at Al-Ibūhaj Primary School for Girls to iron out and validate the study instruments before the main study began. The main

sample consisted of 69 fifth-grade girls at Al-Afrah Primary School for Girls, split by class into an experimental group (EG,  $n = 33$ ) and a control group (CG,  $n = 36$ ).

### 3.3 The Proposed Instructional Program

The program that formed the independent variable was built entirely on paper and consisted of two linked components: an Interactive Vocabulary Guide for pupils and a companion Teachers' and Researchers' Guide. Following DCT principles (Paivio, 1986; Mayer, 2020), every one of the 360 vocabulary items drawn from the curriculum was taught alongside a matching image, through activities such as matching exercises, labeling tasks, worksheets, and vocabulary games. Delivery spanned twenty-eight sessions, four per week for seven weeks, organized into eight curriculum-matched thematic units, two of which were set aside for revision. Activities were pitched at different cognitive levels (recognition, comprehension, application), drawing on Bloom's revised taxonomy (Anderson & Krathwohl, 2001). The control group covered the identical vocabulary content but through ordinary, verbally focused teaching.

### 3.4 Instruments

Vocabulary was measured with three matched twenty-item tests: a pre-test and post-test given to both groups, plus a retention test given to the EG alone, seven weeks after the post-test. Every test used picture-supported items scored as correct or incorrect (1 or 0), split across four question types covering recognition, recall, meaning, and use, built from a Table of Specifications tied to the program's behavioral objectives. All three tests were given under the same standardized conditions within a 40-minute window, a time limit set from the pilot studies.

Content validity rested on the Table of Specifications, and face validity was checked by a panel of thirteen specialists in EFL methodology and linguistics, whose comments led to small changes in wording, item prompts, and images. Reliability, measured with the Kuder–Richardson Formula 20 (KR-20) suited to dichotomously scored tests, is shown in Table 2.

**Table 2** Internal Consistency Reliability of the Study Instruments

| Instrument     | KR-20 | Interpretation |
|----------------|-------|----------------|
| Pre-Test       | 0.72  | Acceptable     |
| Post-Test      | 0.87  | Excellent      |
| Follow-Up Test | 0.82  | Excellent      |

**Note.** A KR-20 coefficient of .70 or above indicates acceptable internal consistency; .80 or above indicates excellent internal consistency.

### 3.5 Procedures

Fieldwork took place at Al-Afrah Primary School for Girls from 8 October to 25 December 2025, after clearance from the relevant education authorities. Both groups sat the pre-test on 8 October 2025 to check that they started at a comparable level. An independent-samples t-test found no meaningful gap between the EG ( $M = 6.18$ ,  $SD = 2.62$ ) and the CG ( $M = 5.47$ ,  $SD = 2.45$ ) at this stage,  $t(67) = 1.160$ ,  $p = .250$ , Cohen's  $d = 0.28$  (Table 3), providing evidence that any later differences could be traced to the treatment rather than pre-existing gaps.

**Table 3** Pre-Test Vocabulary Equivalence of the Experimental and Control Groups

| Group | N  | M    | SD   | t     | df | p    | Cohen's d |
|-------|----|------|------|-------|----|------|-----------|
| CG    | 36 | 5.47 | 2.45 | 1.160 | 67 | .250 | 0.28      |
| EG    | 33 | 6.18 | 2.62 |       |    |      |           |

**Note.** Independent-samples t-test;  $\alpha = .05$ .

The twenty-eight teaching sessions ran from October through December 2025. Both groups completed the post-test on 28 December 2025, right after the teaching period ended, and the EG alone sat the delayed retention test on 19 February 2026, seven weeks after the post-test.

## 3.6 Control of Extraneous Variables and Ethical Considerations

Three common threats to internal validity history, maturation, and dropout were kept in check: both groups followed the same timetable, no unusual school events disrupted the study period, and almost no pupils were lost from either group over the course of the study (Campbell & Stanley, 1963). The research followed the ethical rules set by the Iraqi Ministry of Education: parents or guardians gave informed consent, pupils gave assent in age-appropriate terms, taking part was voluntary with no penalty for withdrawing, and identification codes rather than names kept participants' data confidential.

## 3.7 Data Analysis

SPSS was used for all statistical analysis. Independent-samples t-tests checked group equivalence at pre-test and compared mastery gains at post-test; a paired-samples t-test compared the EG's post-test and follow-up scores. Cohen's d was calculated for effect sizes throughout, and significance was judged against  $\alpha = .05$ .

## 4. RESULTS

### 4.1 Effect of the Instructional Program on Vocabulary Mastery (Hypotheses 1 and 2)

Gain scores (post-test scores minus pre-test scores) were compared across the two groups with an independent-samples t-test. Table 4 shows a clear gap in favor of the EG ( $M = 7.58$ ,  $SD = 3.01$ ) over the CG ( $M = 4.39$ ,  $SD = 2.77$ ),  $t(67) = 4.580$ ,  $p < .001$ , with an unusually large effect size (Cohen's  $d = 2.887$ ). Both the first hypothesis (no effect of the program) and the second (no difference between groups) were therefore rejected.

**Table 4** Vocabulary Mastery Gain Scores of the Experimental and Control Groups

| Group | N  | M    | SD   | t     | df | p      | Cohen's d |
|-------|----|------|------|-------|----|--------|-----------|
| CG    | 36 | 4.39 | 2.77 | 4.580 | 67 | < .001 | 2.887     |
| EG    | 33 | 7.58 | 3.01 |       |    |        |           |

*Note.* Independent-samples t-test;  $\alpha = .05$ .

### 4.2 Vocabulary Retention in the Experimental Group (Hypothesis 3)

To see whether the EG's gains held up over time, a paired-samples t-test compared their post-test and delayed follow-up scores. Table 5 shows follow-up scores ( $M = 14.24$ ,  $SD = 3.47$ ) sitting slightly above, not below, the post-test scores ( $M = 13.79$ ,  $SD = 3.82$ ); the difference was small and statistically unremarkable,  $t(32) = -0.974$ ,  $p = .338$ . The third hypothesis, which predicted a decline in retention, was therefore retained; the vocabulary gains the program produced held steady across the seven-week gap.

**Table 5** Vocabulary Retention Scores of the Experimental Group: Post-Test vs. Delayed Follow-Up

| Test           | N  | M     | SD   | Mean Diff. | t      | df | p (2-tailed) |
|----------------|----|-------|------|------------|--------|----|--------------|
| Post-Test (EG) | 33 | 13.79 | 3.82 | -0.45      | -0.974 | 32 | .338         |
| Follow-Up (EG) | 33 | 14.24 | 3.47 |            |        |    |              |

*Note.* Paired-samples t-test;  $\alpha = .05$ . The follow-up test was administered seven weeks after the post-test.

### 4.3 Summary

Taken together, the three hypothesis tests tell a consistent story: the group taught with the DCT-based program learned more vocabulary than the group taught conventionally, and it kept that vocabulary over the following seven weeks, providing evidence of both an immediate and a lasting instructional benefit.

## 5. DISCUSSION

Taken as a whole, the results back up the idea that a DCT-based program can meaningfully improve vocabulary mastery and retention among fifth-grade Iraqi EFL pupils. Since the two groups started from the same point at pre-test, the much larger gains seen in the experimental group point to the instructional treatment as the likely cause rather than any pre-existing

advantage. This matches what DCT predicts: that learning words through both language and imagery at once builds a stronger, more retrievable memory trace than words taught through language alone (Paivio, 1986; Clark & Paivio, 1991). It also fits earlier findings elsewhere that visual or dual-coded instruction boosts vocabulary learning (Yanasugondha, 2017; Wong & Samudra, 2019; Noor-ul-Ain & Pervaiz, 2023).

The size of the effect (Cohen's  $d = 2.887$ ) points to something more than a statistical curiosity; it suggests a genuinely meaningful classroom advantage, possibly because pairing images with words pushed pupils toward deeper processing, cut down on rote repetition, and built stronger associative links in memory (Sadoski, 2005). That the follow-up scores held steady, if anything ticking up slightly rather than dropping, fits the DCT prediction that dual-coded material gives learners more than one route back to the same memory, making it more resistant to fading (Clark & Paivio, 1991), a pattern other studies of multimodal vocabulary instruction have also reported (Salehpour et al., 2022; Li et al., 2022). What these findings add to the DCT literature is evidence from a setting where classrooms typically have little beyond paper and pencil to work with. The program here relied entirely on printed materials, yet still produced the kind of gains usually associated with more technology-heavy interventions a useful data point for any under-resourced classroom where teachers can manage flashcards and worksheets but not multimedia equipment (Kusumawati & Arifin, 2024; Studies Weekly, 2024).

A few limitations temper how far these results should be pushed. Because whole classes rather than individual pupils were assigned to conditions, the design cannot rule out every alternative explanation as thoroughly as a fully randomized trial could, even with equivalence confirmed at pre-test (Shadish et al., 2002). The sample came from one governorate and included only girls, so the findings may not automatically transfer to boys, mixed classrooms, or other regions. And because the study relied entirely on test scores, it cannot say much about the moment-to-moment cognitive processes behind the gains that interviews or classroom observation might have captured.

## 6. CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

### 6.1 Conclusions

Compared with conventional teaching, the DCT-based program produced a clear, educationally meaningful improvement in vocabulary mastery among fifth-grade Iraqi EFL pupils, and that improvement did not fade over a seven-week gap. In short, teaching curriculum vocabulary through paired words and images works, costs little, and holds up over time in a primary Iraqi classroom, a result that lends concrete, local support to the broader claims of Dual Coding Theory.

### 6.2 Pedagogical Implications and Recommendations

- a. Primary EFL teachers should routinely pair pictures, flashcards, illustrated worksheets, and visual matching tasks with verbal explanation when teaching new vocabulary.
- b. Curriculum designers might build DCT-style activities picture-word matching, visual storytelling, dual-coded exercises directly into primary English textbooks rather than treating them as optional extras.
- c. Teacher-training courses should give trainees hands-on practice using verbal-visual strategies, with an emphasis on materials that do not require technology.
- d. Schools should stock classrooms with basic visual aids, pictures, charts, illustrated materials so that dual-coding techniques are easy for teachers to use day-to-day.

### 6.3 Limitations and Suggestions for Future Research

Given the constraints noted above, later studies could usefully repeat this design with bigger, more geographically spread, and gender-mixed samples to strengthen how broadly the findings apply; test whether DCT-based teaching helps with reading, listening, or writing as well as vocabulary; try the approach with older learners at the intermediate or secondary level; pit DCT-based instruction directly against other vocabulary-teaching strategies; track retention over a longer stretch than seven weeks; and bring in interviews or classroom observation to get at the thinking behind the numbers, not just the numbers themselves.

## REFERENCES

- [1] Agazzi, A. (2022). The importance of learning vocabulary for young learners. *International Journal of Multicultural and Multireligious Understanding*, 9(8), 56–60. <https://doi.org/10.18415/ijmmu.v9i8.3897>

- [2] Ahmed, Z. T., & Ja'afar, I. H. (2020). Investigating Iraqi EFL university students' lexical knowledge: A cross-sectional study. *International Journal of Linguistics, Literature and Translation*, 3(9), 8–19. <https://doi.org/10.32996/ijllt.2020.3.92>
- [3] Al-Khateeb, M. M. A., & Hasan, H. (2016). Language learning strategies used by Iraqi primary school children. *IJAEDU-International E-Journal of Advances in Education*, 2(5), 285–292.
- [4] Al-Obaydi, L. H., & Pikhart, M. (2024). Revisiting Total Physical Response: Evaluating its impact on vocabulary acquisition and retention in EFL classrooms. *Forum for Linguistic Studies*, 6(5), 822–832. <https://doi.org/10.30564/fls.v6i5.7028>
- [5] AlShammari, K. M. M., & Al-Labban, A. S. (2024). *Vocabulary practical strategies: 75 strategies that work* (1st ed.). Al-Sadiq Cultural Foundation.
- [6] Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Longman.
- [7] Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Houghton Mifflin.
- [8] Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin*, 132(3), 354–380. <https://doi.org/10.1037/0033-2909.132.3.354>
- [9] Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review*, 3(3), 149–210. <https://doi.org/10.1007/BF01320076>
- [10] Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- [11] Hameed, H. H., Abood, R. A., & Akbar, N. A. (2020). The effect of using scrabble game strategy on improving vocabulary for 5th Iraqi EFL primary pupils. *Ilkogretim Online*, 19(1), 524–529. <https://doi.org/10.17051/ilkonline.2020.661882>
- [12] Kanellopoulou, C., Kermanidis, K. L., & Giannakouropoulos, A. (2019). The Dual-Coding and multimedia learning theories: Film subtitles as a vocabulary teaching tool. *Education Sciences*, 9(3), 210. <https://doi.org/10.3390/educsci9030210>
- [13] Karimi, F., & Shareef, O. K. (2024). Effects of instructional games on vocabulary learning and retention of Iraqi primary school students. *Research in English Language Pedagogy*, 12(2), 135–149.
- [14] Karpicke, J. D., & Roediger, H. L. (2008). The critical importance of retrieval for learning. *Science*, 319(5865), 966–968. <https://doi.org/10.1126/science.1152408>
- [15] Kusumawati, B. I., & Arifin, S. (2024). Effective vocabulary teaching techniques for EFL teachers in primary classrooms. *JETAL: Journal of English Teaching and Applied Linguistics*, 6(1), 37–46. <https://doi.org/10.36655/jetal.v6i1.1650>
- [16] Lateef, A. A. A., & Dakhil, T. A. (2025). Investigating the impact of all-in-one learning suites on English language learning: A study of Iraqi EFL learners with emphasis on vocabulary and grammar. *TEFL Journal*, 3(1).
- [17] Li, W., Yu, J., Zhang, Z., & Liu, X. (2022). Dual coding or cognitive load? Exploring the effect of multimodal input on English as a foreign language learners' vocabulary learning. *Frontiers in Psychology*, 13, 834706. <https://doi.org/10.3389/fpsyg.2022.834706>
- [18] Mahmood, A. M. A., & Arslan, F. Y. (2017). The relationship between Iraqi EFL learners' vocabulary learning strategies use and their receptive vocabulary size. *Arab World English Journal*, 8(4). <https://dx.doi.org/10.24093/awej/vol8no4.21>
- [19] Mayer, R. E. (2020). *Multimedia learning* (3rd ed.). Cambridge University Press.
- [20] Mohamed, R. A. A. (2021). Dual coding theory and vocabulary learning: Animation and word definition integration. *Annals of the Faculty of Arts, Ain Shams University*, 49(6), 371–395. <https://doi.org/10.21608/aafu.2021.330063>
- [21] Nakata, T., & Elgort, I. (2021). Effects of spacing on contextual vocabulary learning. *Language Learning*, 71(2), 233–260. <https://doi.org/10.1177/0267658320927764>
- [22] Nation, I. S. P. (2013). *Learning vocabulary in another language* (2nd ed.). Cambridge University Press.
- [23] Noor-ul-Ain, & Pervaiz, A. (2023). A comparative analysis of vocabulary development strategies: A dual coding view of Pakistani ESL learners. *Linguistic Forum*, 5(1), 8–15.
- [24] Paivio, A. (1971). *Imagery and verbal processes*. Holt, Rinehart & Winston.
- [25] Paivio, A. (1986). *Mental representations: A dual coding approach*. Oxford University
- [26] Paivio, A. (1991). Dual coding theory: Retrospect and current status. *Canadian Journal of Psychology*, 45(3), 255–287. <https://doi.org/10.1037/h0084295>
- [27] Paivio, A. (2007). *Mind and its evolution: A dual coding theoretical approach*. Lawrence Erlbaum Associates.

- [28] Ponce, H. R., Mayer, R. E., & Méndez, E. E. (2025). Learner-generated and instructor-provided graphic organizers as aids to learning from text: A meta-analysis. *Educational Psychology Review*, 37(4), Article 107. <https://doi.org/10.1007/s10648-025-10084-6>
- [29] Rahmah, N., Tahir, M., & Talib, A. (2023). The effect of vocabulary mastery on students' reading comprehension. *International Journal of Business, English, and Communication*, 1(1), 36–44.
- [30] Rogers, J., & Révész, A. (2019). Experimental and quasi-experimental designs. In J. McKinley & H. Rose (Eds.), *The Routledge handbook of research methods in applied linguistics* (pp. 133–143). Routledge.
- [31] Sadoski, M. (2005). A dual coding view of vocabulary learning. *Reading and Writing Quarterly*, 21(3), 221–238. <https://doi.org/10.1080/10573560590949359>
- [32] Sadoski, M., & Paivio, A. (2013). *Imagery and text: A dual coding theory of reading and writing* (2nd ed.). Routledge.
- [33] Salehpour, S., Behnam, B., & Seifoori, Z. (2022). Enhancing English vocabulary retention among Iranian trainee teachers through literature-based interactive input-output tasks. *Journal of Applied Linguistics and Discourse Analysis*. <https://doi.org/10.22049/jalda.2022.27233.1315>
- [34] Schmitt, N. (2010). *Researching vocabulary: A vocabulary research manual*. Palgrave Macmillan.
- [35] Schmitt, N. (2019). Understanding vocabulary acquisition, instruction, and assessment: A research agenda. *Language Teaching*, 52(2), 261–274. <https://doi.org/10.1017/S0261444819000053>
- [36] Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.
- [37] Studies Weekly. (2024, January 10). Beyond screens: The benefits of paper-based learning for elementary students. <https://www.studiesweekly.com/beyond-screens-the-benefits-of-paper-based-learning-for-elementary-students/>
- [38] Sweller, J., Ayres, P., & Kalyuga, S. (2019). *Cognitive load theory*. Springer.
- [39] Waham, J. J. (2024). Enhancing English communication skills in Iraqi schools. *Pedagogia: Jurnal Ilmu Pendidikan*, 22(3), 197–206. ScopusScopus
- [40] Wong, K. M., & Samudra, P. G. (2019). L2 vocabulary learning from educational media. *Journal of Educational Psychology*. <https://doi.org/10.1037/edu0000401>
- [41] Wooten, J. O., & Cuevas, J. A. (2024). The effects of dual coding theory on social studies vocabulary and comprehension in elementary education. *International Journal on Social and Education Sciences*, 6(4), 673–691. <https://doi.org/10.46328/ijonses.696>
- [42] Yanasugondha, V. (2017). A study of English vocabulary learning using the dual coding theory. *LEARN Journal: Language Education and Acquisition Research Network*, 10(1), 165–175.